Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1.   (currently amended)   A multiparameter high precision concurrent estimation method in image subpixel matching in which in an N-dimensional similarity space where N (N is an integer of four or greater) correspondence parameters between images are axes, said N correspondence parameters between images are estimated ~~precisely and~~ concurrently by using an N-dimensional similarity value between images obtained at discrete positions, comprising the steps of:

        determining a sub-sampling position where said N-dimensional similarity value between images is maximum or minimum on a line in parallel with a certain parameter axis, and determining an N-dimensional hyperplane that most approximates determined said sub-sampling position;

        determining N of said N-dimensional hyperplanes with respect to each parameter axis;

        determining an intersection point of N of said N-dimensional hyperplanes; ~~and~~

        setting said intersection point as a sub-sampling grid estimation position for said correspondence parameter between images that gives a maximum value or a minimum value of N-dimensional similarity in said N-dimensional similarity space; and

        displaying an image deformed by said N correspondence parameters between images that were estimated.

2.   (currently amended)   A three-parameter high precision concurrent estimation method in image subpixel matching in which in a three-dimensional similarity space where three correspondence parameters between images are axes, said three correspondence parameters between images are estimated ~~precisely and~~ concurrently

by using a three-dimensional similarity value between images obtained at discrete positions, comprising the steps of:

determining a sub-sampling position where said three-dimensional similarity value between images is maximum or minimum on a line in parallel with a certain parameter axis, and determining a plane that most approximates determined said sub-sampling position;

determining three of said planes with respect to each parameter axis;

determining an intersection point of three of said planes; ~~and~~

setting said intersection point as a sub-sampling grid estimation position for said correspondence parameter between images that gives a maximum value or a minimum value of three-dimensional similarity in said three-dimensional similarity space<u>; and</u>

<u>displaying an image deformed by said three correspondence parameters between images that were estimated.</u>

3.   (currently amended)   A two-parameter high precision concurrent estimation method in image subpixel matching in which ~~a position of~~ <u>displacements between images in horizontal and vertical directions that give</u> a maximum value or a minimum value of a two-dimensional similarity in a continuous area ~~is~~ <u>are</u> estimated ~~precisely~~ by using a two-dimensional similarity value between images obtained discretely, comprising the steps of:

determining a sub-sampling position where said two-dimensional similarity value between images is maximum or minimum on a line in parallel with a horizontal axis, and determining a line (horizontal extreme value line HEL) that most approximates determined said sub-sampling position;

determining a sub-sampling position where said two-dimensional similarity value between images is maximum or minimum on a line in parallel with a vertical axis, and determining a line (vertical extreme value line VEL) that most approximates determined said sub-sampling position;

determining an intersection point of said horizontal extreme value line HEL and said vertical extreme value line VEL; and

setting said intersection point as a subpixel estimation position <u>for said displacements between images in horizontal and vertical directions</u> that gives̶ a maximum value or a minimum value of said two-dimensional similarity<u>; and</u>

<u>displaying an image deformed by said displacements between images in horizontal and vertical directions that were estimated</u>.

4.   (currently amended)   A multiparameter high precision concurrent estimation <u>computer</u> program <u>embodied in a computer-readable medium</u> in image subpixel matching in which in an N-dimensional similarity space where N (N is an integer of four or greater) correspondence parameters between images are axes, said N correspondence parameters between images are estimated p̶r̶e̶c̶i̶s̶e̶l̶y̶ ̶a̶n̶d̶ concurrently by using an N-dimensional similarity value between images obtained at discrete positions, said <u>multiparameter high precision concurrent estimation computer</u> program is executable with a computer, comprising the functions of:

determining a sub-sampling position where said N-dimensional similarity value between images is maximum or minimum on a line in parallel with a certain parameter axis, and determining an N-dimensional hyperplane that most approximates determined said sub-sampling position;

determining N of said N-dimensional hyperplanes with respect to each parameter axis;

determining an intersection point of N of said N-dimensional hyperplanes; a̶n̶d̶

setting said intersection point as a sub-sampling grid estimation position for said correspondence parameter between images that gives a maximum value or a minimum value of N-dimensional similarity in said N-dimensional similarity space<u>; and</u>

<u>displaying an image deformed by said N correspondence parameters between images that were estimated</u>.

5.   (currently amended)   A three-parameter high precision concurrent estimation <u>computer</u> program <u>embodied in a computer-readable medium</u> in image subpixel matching in which in a three-dimensional similarity space where three

correspondence parameters between images are axes, said three correspondence parameters between images are estimated ~~precisely and~~ concurrently by using a three-dimensional similarity value between images obtained at discrete positions, said three-parameter high precision concurrent estimation computer program is executable with a computer, comprising the functions of:

determining a sub-sampling position where said three-dimensional similarity value between images is maximum or minimum on a line in parallel with a certain parameter axis, and determining a plane that most approximates determined said sub-sampling position;

determining three of said planes with respect to each parameter axis;

determining an intersection point of three of said planes; ~~and~~

setting said intersection point as a sub-sampling grid estimation position for said correspondence parameter between images that gives a maximum value or a minimum value of three-dimensional similarity in said three-dimensional similarity space; and

displaying an image deformed by said three correspondence parameters between images that were estimated.

6.   (currently amended)   A two-parameter high precision concurrent estimation computer program embodied in a computer-readable medium in image subpixel matching in which a position of displacements between images in horizontal and vertical directions that give a maximum value or a minimum value of a two-dimensional similarity in a continuous area ~~is~~ are estimated ~~precisely~~ by using a two-dimensional similarity value between images obtained discretely, said two-parameter high precision concurrent estimation computer program is executable with a computer, comprising the functions of:

determining a sub-sampling position where said two-dimensional similarity value between images is maximum or minimum on a line in parallel with a horizontal axis, and determining a line (horizontal extreme value line HEL) that most approximates determined said sub-sampling position;

determining a sub-sampling position where said two-dimensional similarity value between images is maximum or minimum on a line in parallel with a vertical axis, and determining a line (vertical extreme value line VEL) that most approximates determined said sub-sampling position;

determining an intersection point of said horizontal extreme value line HEL and said vertical extreme value line VEL; and

setting said intersection point as a subpixel estimation position <u>for said displacements between images in horizontal and vertical directions</u> that gives a maximum value or a minimum value of said two-dimensional similarity<u>; and</u>

<u>displaying an image deformed by said displacements between images in horizontal and vertical directions that were estimated.</u>

7.   (new)   A multiparameter high precision concurrent estimation method in image subpixel matching in which in an N-dimensional similarity space where N (N is an integer of four or greater) correspondence parameters between images are axes, said N correspondence parameters between images are estimated concurrently by using an N-dimensional similarity value between images obtained at discrete positions, comprising the steps of:

determining a sub-sampling position where said N-dimensional similarity value between images is maximum or minimum on a line in parallel with a certain parameter axis, and determining an N-dimensional hyperplane that most approximates determined said sub-sampling position;

determining N of said N-dimensional hyperplanes with respect to each parameter axis;

determining an intersection point of N of said N-dimensional hyperplanes;

setting said intersection point as a sub-sampling grid estimation position for said correspondence parameter between images that gives a maximum value or a minimum value of N-dimensional similarity in said N-dimensional similarity space; and

displaying said N correspondence parameters between images that were estimated with numerical value.

8.   (new)   A three-parameter high precision concurrent estimation method in
image subpixel matching in which in a three-dimensional similarity space where three
correspondence parameters between images are axes, said three correspondence
parameters between images are estimated concurrently by using a three-dimensional
similarity value between images obtained at discrete positions,
comprising the steps of:
    determining a sub-sampling position where said three-dimensional similarity value
between images is maximum or minimum on a line in parallel with a certain parameter
axis, and determining a plane that most approximates determined said sub-sampling
position;
    determining three of said planes with respect to each parameter axis;
    determining an intersection point of three of said planes;
    setting said intersection point as a sub-sampling grid estimation position for said
correspondence parameter between images that gives a maximum value or a minimum
value of three-dimensional similarity in said three-dimensional similarity space; and
    displaying said three correspondence parameters between images that were
estimated with numerical value.

9.   (new)   A two-parameter high precision concurrent estimation method in image
subpixel matching in which displacements between images in horizontal and vertical
directions that give a maximum value or a minimum value of a two-dimensional
similarity in a continuous area are estimated by using a two-dimensional similarity value
between images obtained discretely,
comprising the steps of:
    determining a sub-sampling position where said two-dimensional similarity value
between images is maximum or minimum on a line in parallel with a horizontal axis, and
determining a line (horizontal extreme value line HEL) that most approximates
determined said sub-sampling position;

determining a sub-sampling position where said two-dimensional similarity value between images is maximum or minimum on a line in parallel with a vertical axis, and determining a line (vertical extreme value line VEL) that most approximates determined said sub-sampling position;

determining an intersection point of said horizontal extreme value line HEL and said vertical extreme value line VEL; and

setting said intersection point as a subpixel estimation position for said displacements between images in horizontal and vertical directions that give a maximum value or a minimum value of said two-dimensional similarity; and

displaying said displacements between images in horizontal and vertical directions that were estimated with numerical value.

10.   (new)   A multiparameter high precision concurrent estimation computer program embodied in a computer-readable medium in image subpixel matching in which in an N-dimensional similarity space where N (N is an integer of four or greater) correspondence parameters between images are axes, said N correspondence parameters between images are estimated concurrently by using an N-dimensional similarity value between images obtained at discrete positions,

said multiparameter high precision concurrent estimation computer program is executable with a computer, comprising the functions of:

determining a sub-sampling position where said N-dimensional similarity value between images is maximum or minimum on a line in parallel with a certain parameter axis, and determining an N-dimensional hyperplane that most approximates determined said sub-sampling position;

determining N of said N-dimensional hyperplanes with respect to each parameter axis;

determining an intersection point of N of said N-dimensional hyperplanes;

setting said intersection point as a sub-sampling grid estimation position for said correspondence parameter between images that gives a maximum value or a minimum value of N-dimensional similarity in said N-dimensional similarity space; and

displaying said N correspondence parameters between images that were estimated with numerical value.

11.   (new)   A three-parameter high precision concurrent estimation computer program embodied in a computer-readable medium in image subpixel matching in which in a three-dimensional similarity space where three correspondence parameters between images are axes, said three correspondence parameters between images are estimated concurrently by using a three-dimensional similarity value between images obtained at discrete positions,

  said three-parameter high precision concurrent estimation computer program is executable with a computer, comprising the functions of:

    determining a sub-sampling position where said three-dimensional similarity value between images is maximum or minimum on a line in parallel with a certain parameter axis, and determining a plane that most approximates determined said sub-sampling position;

    determining three of said planes with respect to each parameter axis;

    determining an intersection point of three of said planes;

    setting said intersection point as a sub-sampling grid estimation position for said correspondence parameter between images that gives a maximum value or a minimum value of three-dimensional similarity in said three-dimensional similarity space; and

    displaying said N correspondence parameters between images that were estimated with numerical value.

12.   (new)   A two-parameter high precision concurrent estimation computer program embodied in a computer-readable medium in image subpixel matching in which displacements between images in horizontal and vertical directions that give a maximum value or a minimum value of a two-dimensional similarity in a continuous area are estimated by using a two-dimensional similarity value between images obtained discretely,

   said two-parameter high precision concurrent estimation computer program is executable with a computer, comprising the functions of:

   determining a sub-sampling position where said two-dimensional similarity value between images is maximum or minimum on a line in parallel with a horizontal axis, and determining a line (horizontal extreme value line HEL) that most approximates determined said sub-sampling position;

   determining a sub-sampling position where said two-dimensional similarity value between images is maximum or minimum on a line in parallel with a vertical axis, and determining a line (vertical extreme value line VEL) that most approximates determined said sub-sampling position;

   determining an intersection point of said horizontal extreme value line HEL and said vertical extreme value line VEL; and

   setting said intersection point as a subpixel estimation position for said displacements between images in horizontal and vertical directions that give a maximum value or a minimum value of said two-dimensional similarity; and

   displaying said displacements between images in horizontal and vertical directions that were estimated with numerical value.